

I664.805655  
SOYM  
c.3

# *Soy milk and Dairy Analog*s

International Soybean Program  
College of Agriculture  
University of Illinois  
at Urbana-Champaign



## *Advantages of Soymilk Products*

One of the simplest methods for converting soybeans to a high-quality food is to produce a beverage known as soymilk. This product contains virtually the same amount of protein as cow's milk and is free of cholesterol and lactose. Soymilk is especially important for people who are allergic to the lactose in cow's milk.

Although less serious in the United States or Europe, the inability to digest the milk sugar lactose occurs widely in developing nations. Rates from 50 percent to almost 100 percent have been recorded among population groups in Asia, Africa, and Latin America.

Because soymilk contains no lactose and is relatively inexpensive, it offers an attractive alternative to cow's milk for hundreds of millions of people in developing countries, as well as many people in developed countries.

## *Soymilk Acceptance Problems*

Soymilk has been a staple in the Orient for many centuries. It is traditionally made by soaking the beans, grinding them with water, cooking the slurry, and then filtering to remove the sludge.

Unfortunately, the traditional soymilk has a distinctive beany flavor which is unacceptable to most consumers outside the Orient. This objectionable flavor results from the action of an enzyme when raw soybeans are ground and exposed to moisture.

The acceptability of soymilk has been further complicated by the unjustified tendency to compare it with cow's milk. Thus, in producing a widely acceptable soymilk, it is essential to carefully control a range of factors, including flavor, color, viscosity, and freshness.

ILLINOIS STATE LIBRARY



3 1129 00492 9972

## *Improved Soymilk Processes*

Several of the problems associated with soymilk were solved as early as 1970 with a beverage developed by food scientists at the University of Illinois. The product is made by cooking and grinding the beans in a way that inactivates the enzyme responsible for causing the objectionable beany flavor.

The Illinois process utilized the whole soybean and produced a soy beverage with bland flavor, excellent suspension stability, and good taste characteristics. Serious acceptance problems ensued, however, because the product tended to leave a chalky feeling in the mouth. Patent restrictions further limited use of this process in many less developed areas.

## *INTSOY Home And Village Processing*

Recently INTSOY has developed a new, inexpensive method to prepare soymilk at the home and village level. This small-scale preparation process in simplified form is as follows:

- Drop whole, raw beans directly into boiling water containing a small amount of sodium bicarbonate and blanch for 5 minutes.
- Drain the water, add the partially blanched beans to fresh boiling water containing sodium bicarbonate, and cook for 5 more minutes.
- Drain the blanch water and grind the beans along with additional boiling water in an electric blender or hand grinder.
- Stir the slurry well and filter with a finely woven, moist cheesecloth. Squeeze out as much milk as possible.
- Simmer the filtrate for 20 minutes.
- Add sugar and flavoring and pour into holding containers.



Heat treatment is the most important step. It is absolutely necessary to hydrate and thoroughly heat raw soybeans before grinding into a slurry to prevent development of the typical beany flavor. This process adequately destroys the antinutritional Trypsin inhibitor.

Boiling times longer than recommended will reduce the amount of protein in the final product. The concentration of solids can be easily adjusted according to the final use of the soymilk.

## *New Commercial Process*

Commercial soymilk processing equipment with an average capacity of 2,000 liters per hour is currently available for purchase with aseptic packaging from several sources at a cost of several million dollars. At present, however, there is a lack of available equipment and proven processing techniques for producing sterile product in volumes larger than the home level and less than 600 to 800 liters per hour.

A major focus of INTSOY research is on scaling up the improved soymilk processing techniques from the laboratory to the medium commercial scale. In simplified form, the process is as follows:

- Clean and size whole soybeans.
- Dry the beans by forced air in an oven.
- Split the hot beans in a dehuller roller.
- Separate the hulls and the cotyledons using an air blower.
- Blanch the dehulled soybeans in a steam kettle.
- Grind blanched beans on a continuous basis along with boiling water in a hammer mill.
- Continuously extract the soymilk from the ground slurry using the roller extractor from an adapted tofu machine.
- Pasteurize and homogenize the soymilk.

Long blanching times lower the recovery of nutrients. Very short cooking times are inadequate to destroy the enzyme that causes the beany flavor.

## ***Making Dairy Analogs***

The soymilk from this process is a bland product suitable for making a number of dairy analogs:

**Soy Yogurt**—Yogurt is a tasty and nutritious product made by fermenting cow's milk to form an acidic gel. Soy yogurt is less acidic than regular yogurt and should have widespread consumer appeal. The steps for making soy yogurt using the same culture as the one used for regular yogurt are as follows:

- Manufacture the soymilk.
- Formulate the soymilk with sucrose and dextrose.
- Pasteurize and homogenize.
- Inoculate and incubate.

The culture must be carefully maintained. The temperature and time of incubation should be carefully controlled. The soymilk must be properly pasteurized to prevent contamination. A small amount of added sugar promotes the fermentation. The use of different sugars or sugar mixtures produce somewhat different flavors in the final product.

**Soy Ice Cream**—This product is prepared from the soymilk and added vegetable oil. It is formulated and manufactured as in the conventional dairy ice cream process. The soy ice cream stores well and has good melt-down characteristics.

## ***Developing Commercial Products***

An excellent soymilk containing more than 5 percent protein has already been prepared using this scaled-up method. At that concentration, about 10 kilograms of dehulled soybeans are needed to produce 50 kilograms of soymilk.

This product contains about 10 percent total solids. That compares to cow's milk which has 10 to 12 percent solids, including about 4 percent protein. This soymilk should be nearly ideal as a base for commercial soft-serve ice cream products.



3 0112 122551457

The okara or residue from the commercial process can be used immediately in baking or dried for later use as a high-fiber flour. The okara contains about 8 percent protein on a wet basis or about 40 percent on a dry basis.

## *Benefits*

The equipment used in this research is relatively inexpensive and widely available. It could be easily linked into a commercial soymilk operation with a volume of 100 to 200 liters per hour. With a larger roller extractor, the capacity could be expanded to as much as 600 to 800 liters per hour.

The new commercial-scale process being developed by INTSOY therefore represents a major step toward effectively meeting the huge world-wide need for soymilk. The benefits should include the following:

- A soymilk plant producing 100 to 800 liters per hour would be much less expensive than the available turn-key operations.
- Smaller processing plants that prepare pasteurized products for local rather than nationwide distribution would not need costly aseptic packaging equipment.
- The moderate cost for this type of operation could be particularly important for promoting soymilk in areas where there is a strong need for a high-protein beverage but only a limited amount of investment capital.

Contact us for further information about INTSOY programs and publications.

International Soybean Program  
University of Illinois at Urbana-Champaign  
113 Mumford Hall  
1301 W. Gregory Drive  
Urbana, IL 61801 USA

Telex: 20657  
Cable: INTSOY  
Telephone: (217) 333-6422

INTSOY is an affirmative action/equal opportunity employer.